PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2004-213971
(43)Date of publication of application : 29.07.2004

(51)Int.Cl. H01M 10/04
H01M 2/10
H01M 4/02
H01M 6/40
H01M 10/40

(21)Application number : 2002-380598
(22)Date of filing : 27.12.2002

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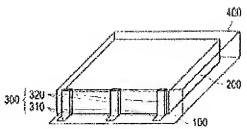
(54) LAMINATE TYPE BATTERY AND ITS MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a laminate type battery that has a good space efficiency.
SOLUTION: This laminate type battery is realized by laminating on a substrate board (100) a plurality of layers which are patterned so that a battery element part (200) and an electric circuit part (300) may be formed by laminating.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

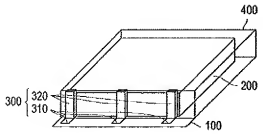
CLAIMS

[Claim(s)]
[Claim 1]
Two or more layers are the laminate type batteries which it comes to laminate on a base,
By laminating, two or more layers concerned are patterned so that a battery element part and an electric circuit part may be formed,
The battery element part concerned has a cell with which it comes to insert that by which a positive electrode layer, an electrolyte layer, and a negative electrode layer were laminated in order by a collector layer from both sides,
A laminate type battery comprising:
An electrode terminal for said electric circuit part to connect said collector layer to an external device.
An electric circuit for connecting collector layer concerned and the electrode terminal concerned.

[Claim 2]
Said battery element part has said two or more cells by which the series connection was carried out,
The laminate type battery comprising according to claim 1:
A positive pole terminal and a negative pole terminal for said electric circuit part to connect to an external device a collector layer by the side of a positive electrode layer which exists in both ends of the battery element part concerned, and a collector layer by the side of a negative electrode layer, respectively.
An electric circuit for connecting the positive pole terminal concerned and a negative pole terminal, and a collector layer corresponding to these.

[Claim 3]

Drawing selection Representative drawing



[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
This invention relates to a laminate type battery with which it comes to laminate two or more layers, and a manufacturing method for the same.
[0002]
[Description of the Prior Art]
A positive electrode material and a negative pole material are applied to both sides of the metallic foil used as a charge collector by a coating machine, a bipolar electrode is created, and the bipolar battery constituted on both sides of two or more electrolyte sheets with two or more bipolar electrodes is known. Although this bipolar battery is closed with the laminate film, at least two charge collectors have extended from this laminate film. It is connected to the electrode terminal and connection between a cell and an external device is possible for these two charge collectors via the electrode terminal concerned.
[0003]
[Problem(s) to be Solved by the Invention]
However, since the above-mentioned bipolar battery has the composition with which many members were combined, it has the problem that space efficiency is bad.
[0004]
This invention is made in view of the above-mentioned problem, and the purpose is to provide a space-efficient laminate type battery and a manufacturing method for the same.
[0005]
[Means for Solving the Problem]
The 1st invention for solving above-mentioned SUBJECT and attaining the purpose, Two or more layers are the laminate type batteries which it comes to laminate on a base, and two or more layers concerned, Are patterned so that a battery element part and an electric circuit part may be formed by laminating, and the battery element part concerned, That by which a positive electrode layer, an

electrolyte layer, and a negative electrode layer were laminated in order has a cell which it comes to insert by a collector layer from both sides, and said electric circuit part has an electric circuit for connecting an electrode terminal, and collector layer concerned and the electrode terminal concerned for connecting said collector layer to an external device.

[0006]

On a base, the 2nd invention is a manufacturing method of a laminate type battery which makes a collector layer, a positive electrode layer, an electrolyte layer, and a negative electrode layer laminate, and forms at least one layer by applying coating liquid among said two or more layers.

[0007]

[Effect of the Invention]

According to the 1st invention, since two or more layers patterned so that a battery element part and an electric circuit part might be formed by laminating are made to laminate and a laminate type battery is realized, a space-efficient laminate type battery can be provided.

[0008]

According to the 2nd invention, since at least one layer of a laminate type battery is formed by applying coating liquid, facilitating of manufacture of the laminate type battery concerning the 1st invention can be attained.

[0009]

[Embodiment of the Invention]

Below, with reference to an accompanying drawing, the suitable embodiment about a laminate type battery concerning this invention and a manufacturing method for the same is divided into a 2nd embodiment from a 1st embodiment, and is described in detail.

[0010]

(A 1st embodiment)

Hereafter, the laminate type battery concerning a 1st embodiment is explained with reference to Drawings.

[0011]

Drawing 1 is an appearance lineblock diagram of the laminate type battery concerning this embodiment. This laminate type battery has the base 100, and two or more layers are laminated on this base 100. By laminating, the layer of these plurality is patterned so that the battery element part 200, the electric circuit part 300, and the insulating part 400 may be formed. The electric circuit part 300 has the electric circuit 320 for connecting the electrode terminal 310, and the electrode terminal 310 concerned and the battery element part 200 for connecting the laminate type battery concerned to an external device. The battery element part 200 and the electric circuit part 300 expose the electrode terminal 310, and are covered with the insulating part 400. Thereby, the seal of the battery element part 200 and the electric circuit part 300 is insulated and carried out. According to this embodiment, the Celcon troller 2000 (refer to drawing 4) is connected to all the electrode terminals 310 as an external device. Here, since the voltage between each electrode terminal is adjusted and it is generally known in order to charge a cell uniformly, the Celcon troller 2000 omits detailed explanation. The external device connected to the electrode terminal 310 may

not be restricted to the Celcon troller 2000, but may be other things, such as electric load and a battery charger.

[0012]

Drawing 2 is a figure showing the laminated structure of the battery element part 200. The battery element part 200 of this embodiment has the two cells 210 by which the series connection was carried out. The number in particular of the cells 210 is not limited. The cell 210 is constituted from the positive electrode layer 211a and negative electrode layer 211c side by the collector layer 212 on both sides of the cell layer 211 with the structure where the electrolyte layer 211b was made to intervene between the positive electrode layer 211a and the negative electrode layer 211c. The positive electrode layer 211a is laminated at the one side of the one collector layer 212, the negative electrode layer 211c is laminated at the other side, and the laminate type battery of this embodiment is what is called a bipolar battery as shown in drawing 2.

[0013]

Drawing 3 is a perspective view of the laminate type battery for explaining the electric circuit part 300. The electric circuit part 300 has the electrode terminal 310 which is an interface for the laminate type battery concerned to exchange an external device and the electrical and electric equipment. The positive pole terminal 311 for the electrode terminal 310 to connect to an external device the collector layer 212a by the side of the positive electrode layer 211a which exists in the end of the battery element part 200, It consists of the negative pole terminal 313 for connecting to an external device the collector layer 212c by the side of the negative electrode layer 211c which exists in the end of the battery element part 200, and the bipolar electrode terminal 312 for connecting to an external device the collector layer 212b which exists in the middle of the battery element part 200. When the number of the cells 210 is one, or when not connecting to the external device of Celcon troller 2000 grade the collector layer 212b which exists in the middle of the battery element part 200, the bipolar electrode terminal 312 does not need to be formed. It is not necessary to form the bipolar electrode terminal 312 about all the collector layers 212b that exist in the middle, and what is necessary is just to provide if needed, when the battery element part 200 has two or more cells 210.

[0014]

The electric circuit part 300 has the electric circuit 320 for connecting these electrode terminals 310 and the collector layer 212 corresponding to these again. The electric circuit 321 where the electric circuit 320 connects the positive pole terminal 311 and the collector layer 212a by the side of the positive electrode layer 211a to which it exists in the end of the battery element part 200, The electric circuit 322 which connects the electric circuit 323 which connects the negative pole terminal 313 and the collector layer 212c by the side of the negative electrode layer 211c which exists in the end of the battery element part 200, and the bipolar electrode terminal 312 and the collector layer 212b which exists in the middle of the battery element part 200, and **, ** and others

[0015]

The insulating part 400 is formed in order to prevent the short circuit (it is a short circuit between

the positive electrode layer 211a and the negative electrode layer 211c especially) between each member (each class of the battery element part 200, the electrode terminal 310, and the electric circuit 320) of a laminate type battery, and the short circuit of each member of a laminate type battery, and an outer conductor. The insulating part 400 also plays a role of a sealing member of the battery element part 200 and the electric circuit 320.

[0016]

Since two or more layers laminated on the base constitute a laminate type battery according to the laminate type battery built over this embodiment as above, a space-efficient laminate type battery is realizable.

[0017]

Since two or more layers are patterned so that the battery element part 200 and the electric circuit part 300 may be formed by laminating, they can form the battery element part 200 and the electric circuit part 300 in one, and can attain facilitating of manufacture.

[0018]

Since two or more layers are patterned so that the battery element part 200, the electric circuit part 300, and the insulating part 400 may be formed by laminating, The battery element part 200 and the electric circuit part 300 by which a seal should be carried out, and the insulating part 400 which is seal parts can be formed in one, and sealing nature can be raised. This effect is remarkable when many cells 210 pull out the electrode terminal 310 from each cell 210 in the laminate type battery connected in series. Drawing 4 is an appearance top view of the laminate type battery to which it comes to connect many cells in series. In drawing 4, the laminate type battery 1000 has many electrode terminals 310 picked out from a majority of cells [each of] (un-illustrating), and these electrode terminals 310 are connected to the Celcon troller 2000. Thus, even when forming many electrode terminals 310, according to the composition of the laminate type battery concerning this embodiment, good sealing nature can be acquired.

[0019]

Since two or more layers are patterned so that the insulating part 400 may be formed by laminating, they can prevent the short circuit of each member of a laminate type battery, and the short circuit of each member and the exterior.

[0020]

Since the capacity of cell 210 comrades generally differs from resistance etc. delicately when connecting two or more cells 210 in series, the variation in the voltage of cell 210 comrades arises by repeating charge and discharge. As a result, degradation advances gradually from the cell whose voltage is comparatively high, and the life of there to the whole cell becomes short. However, in the laminate type battery concerning this embodiment, since the Celcon troller 2000 for voltage adjustment is connected to the electrode terminal 310, it can charge good and reinforcement of a laminate type battery can be attained.

[0021]

Although the same material constitutes the collector layer which touches the positive electrode layer 211a, and the collector layer which touches the negative electrode layer 211c from this

embodiment, it is good also as constituting both from a different material. That is, the collector layer 212 may comprise two kinds of layers.

[0022]

The laminate type battery concerning this embodiment can also constitute the laminate type battery with which two or more cells 210 have the composition by which multiple connection was carried out, although two or more cells 210 have the composition by which the series connection was carried out. If lamination is changed, various laminate type batteries, such as composition in which a series connection and multiple connection were intermingled, can be constituted.

[0023]

Below, the manufacturing method of the laminate type battery concerning this embodiment is explained. In the manufacturing method of this embodiment, each class of a laminate type battery is formed by applying the coating liquid for forming each class of a laminate type battery to the predetermined field on a base in piles in predetermined order. As a method of applying coating liquid and forming a coating film, although an inkjet method, spray printing, electrostatic atomization, sputtering, etc. are mentioned, an inkjet method is adopted by this embodiment.

[0024]

According to this embodiment, a laminate type battery is manufactured using the ink-jet printer which has five printer heads. The coating liquid for anodes for five printer heads to form the positive electrode layer 211a, respectively, It is a head for applying the coating liquid for an insulation for forming the coating liquid for electric conduction for forming the coating liquid for electrolytes, the collector layer 212, and the electric circuit part 300 for forming the coating liquid for negative electrodes for forming the negative electrode layer 211c, and the electrolyte layer 211b, and the insulating part 400. These printer heads are controlled and the various above-mentioned coating liquid is injected by a predetermined pattern on a base. After the solvent in this coating liquid evaporates and coating liquid solidifies, various coating liquid is injected in piles by the predetermined pattern which should be formed in the next. Here, in order to promote evaporation of a solvent, or solidification of coating liquid, after applying coating liquid, it is preferred optical to heat-treat or process the coating film formed with the coating liquid concerned. A desired laminate type battery is manufactured by the number of predetermined times repeating such operation.

[0025]

Drawing 5 is a figure showing the pattern of each class of the laminate type battery concerning this embodiment, i.e., the injection pattern of coating liquid. The laminate type battery of this embodiment can be manufactured by forming on a base each pattern shown in drawing 5 one after another from the 1st layer to the top layer.

[0026]

The details about manufacture of the materials used for the manufacturing method of the laminate type battery concerning this embodiment next, manufacturing installations, etc. are explained. The laminate type battery explained below is a lamination type polymer battery.

[0027]

The base 100 comprises electric insulation material (for example, thing which vapor-deposited the thin film of the SiO_2 insulator on metal).

[0028]

The coating liquid for anodes mixes and stirs positive active material, polymer, a polymerization initiator, an electric conduction auxiliary agent, and a solvent, and adjusts viscosity. According to this embodiment, $LiMn_2O_4$, polyethylene oxide (PEO), azobisuisobutironitoriru, acetylene black, and NMP are used as each material. Here, as for the particle diameter of positive active material, it is preferred that it is 0.1-20 micrometers. This is because contact of active materials will not be able to be taken but contact resistance will increase in 0.1micro or less, and is because the reaction surface area of an active material will become small and the resistance as a cell will increase in not less than 20 micrometers. It is because a possibility that power will be applied to membranous [a part of], and an electrolyte membrane will break and short-circuit as a result will become high in not less than 20 micrometers when unevenness of the surface of an electrode layer becomes large and uses a thin electrolyte membrane. As for the mass ratio to the whole coating liquid of positive active material, by a gel polymer cell, it is preferred that it is 20 to 60% by an intrinsic polymer (all the solids) Polymer Division cell 80 to 90%.

[0029]

The coating liquid for negative electrodes mixes and stirs negative electrode active material, polymer, a polymerization initiator, and a solvent, and adjusts viscosity. According to this embodiment, carbon system material (what was ground in particle diameter of 5 micrometers or less), polyethylene oxide (PEO), azobisuisobutironitoriru, and NMP are used as each material. It is preferred that the particle diameter of negative electrode active material is 0.1-20 micrometers by the same Reason as positive active material here. As for the mass ratio to the whole coating liquid of positive active material, by a gel polymer cell, it is preferred that it is 20 to 60% in an intrinsic polymer battery 80 to 90%.

[0030]

In the paste of Cu particles or carbon particulates, the coating liquid for electric conduction reduces viscosity using a solvent (NMP). Although the coating liquid for forming the coating liquid and the electric circuit for forming the collector layer 212 is made the same in this embodiment, different coating liquid may be used. Although the same coating liquid is used in this embodiment in the negative pole collector layer which touches the positive electrode collector layer which touches the positive electrode layer 211a, and the negative electrode layer 211c, different coating liquid may be used. At this time, as for the coating liquid for forming a positive electrode collector layer, it is preferred to contain carbon particulates, and, as for the coating liquid for forming a negative pole collector layer, it is preferred to contain Cu particles. It cannot be overemphasized that each printer head is needed in these cases.

[0031]

The coating liquid for an insulation is a polysilazane solution, and the coating liquid for electrolytes mixes polyethylene oxide and NMP.

[0032]

As for all the particles (battery construction material) contained in each of above-mentioned coating liquid, it is preferred that it is 5 micrometers or less. It is for avoiding that this gets these particles blocked in the nozzle of a printer head. In order to prevent blinding of this nozzle, it is preferred to form the filter for the prevention from blinding in a printer head.

[0033]

0.5-20 micrometers and the electrolyte layer 211b are 0.5-50 micrometers, and the positive electrode layer 211a and the negative electrode layer 211c is [the collector layer 212 of both the thickness of above-mentioned each class] 0.1-20 micrometers.

[0034]

As for the viscosity of coating liquid, in order to enable spreading by the existing inkjet printer head, it is preferred that they are 20 or less mPa-s. The viscosity of coating liquid can be reduced by adding a solvent. However, if a solvent is added, an active material will become sparse, and the electrical contact resistance of active materials will increase. Then, it is preferred it not only to to add a solvent, but to heat a printer head and to reduce the viscosity of coating liquid. According to this embodiment, a ribbon heater is twisted around a printer head and internal coating liquid is heated. As for cooking temperature, it is preferred that it is the temperature which is a grade which the thermal polymerization of the temperature to which a solvent does not evaporate, and polymer does not follow. The composition of the printer head used for drawing 6 in the manufacturing method of this embodiment is shown. In drawing 6, the blinding prevention filter 520 for preventing blinding of the nozzle 510 is formed in the inside of the printer head 500. The ribbon heater 530 is twisted near the nozzle 510 as a head heating method for heating the printer head 500. It is good also considering filter 520 the very thing for the prevention from blinding as a heater to replace with this ribbon heater 530. That is, it is good also as heating a printer head with the filter 520 for the prevention from blinding. Thus, the miniaturization of the printer head 500 can be attained by unifying the filter and heater for the prevention from blinding.

[0035]

As for the polymer contained in the above-mentioned coating liquid, being accommodated in the microcapsule is preferred because of the stability. In this case, it is necessary to dissolve a microcapsule by heat treatment after spreading of the coating liquid concerned.

[0036]

As for the base 100, being heated is preferred. This is for [in order to evaporate the solvent contained in the applied liquid material] carrying out thermal polymerization of the polymer component which has not polymerized. It is heated by about 130 ** in this embodiment. As for the base 100, it is more preferred than the viewpoint of the increase in efficiency of heating that thermal conductivity is large. As for coating liquid, in order to prevent the chemical reaction of coating liquid and the gas in atmosphere, applying and drying in an inert atmosphere is preferred. According to this embodiment, spreading and desiccation of coating liquid are performed in the chamber of 3% of hydrogen, and 97% of nitrogen.

[0037]

The manufacturing method of the laminate type battery concerning this embodiment has the following effects.

[0038]

Since a laminate type battery is manufactured by applying two or more coating liquid one by one, a process can be lessened compared with the conventional manufacturing method. Facilitating of manufacture of a laminate type battery can be attained.

[0039]

Since it applies patterning coating liquid only after a required portion, the amount of the raw material used can be reduced.

[0040]

Since the pattern and thickness of each class are freely controllable, the cell of various capacity, size, and shape can be designed and manufactured easily.

[0041]

A uniform thin film can be formed on monotonous and facilitating of manufacture of a thin high-output cell can be attained. In particular, lamination of a cell becomes easy and production of a high-tension bipolar battery is attained.

[0042]

Here, in this embodiment, since coating liquid is applied with an inkjet method, the above-mentioned effect is acquired more notably. This is because the ink jet method has the unnecessary part number unlike print processes. Although control of fine size is difficult by the spray method and an electrostatic atomization method, it is because the control concerned is easy by the ink jet method. Since it is a print type, the form of a cell, the position of the electrode terminal 310, etc. can be changed freely, and a pattern, the information on a cell, etc. can be printed simultaneously if needed. Drawing 7 (a) The outline view of the laminate type battery which has various gestalten in - (d) is shown.

[0043]

Where spreading of various coating liquid is completed, it is not necessary to be necessarily a cell which is a finished product, and the process of cutting or pasting together may enter after spreading and a drying process.

[0044]

(A 2nd embodiment)

Two or more laminate type batteries concerning a 1st embodiment of the above are formed on the same base, and it comes to connect the cell group concerning this embodiment in series or in parallel. Hereafter, although this embodiment is described using Drawings, explanation is omitted about the portion which is common in a 1st embodiment.

[0045]

Drawing 8 is a figure showing the composition of the cell group concerning this embodiment. In drawing 8, two or more laminate type batteries 1000 are formed on the same base 100, and are mutually connected by the tab part 3000. According to this embodiment, two or more laminate type batteries 1000 are connected in series, and each tab part 3000 is connected to the Celcon troller

2000 by the track 4000. The tab part 3000 is a broad metal thin film, and the tab part 3000 and the track 4000 are formed on the base 100. The tab part 3000 was made broad in order to make internal resistance small as much as possible.

[0046]

The cell group concerning this embodiment is manufactured by the same manufacturing method as the laminate type battery concerning a 1st embodiment. In particular, according to the inkjet method, the cell group concerning this embodiment can be easily manufactured by patterning.

[0047]

Since [according to the cell group concerning this embodiment] two or more laminate type batteries 1000 are formed on the same base, a thin high-output cell is realizable.

[0048]

Although it supposes that two or more laminate type batteries 1000 will be connected in series in this embodiment, these may be connected in parallel.

[0049]

If two or more cell groups concerning this embodiment are connected in series or in parallel, a cell group module can be constituted. With this cell group module, a still high power thin high-output cell is realizable.

[Brief Description of the Drawings]

[Drawing 1]It is an appearance lineblock diagram of the laminate type battery concerning a 1st embodiment.

[Drawing 2]It is a figure showing the laminated structure of the battery element part of this embodiment.

[Drawing 3]It is a perspective view of the laminate type battery for explaining the electric circuit part of this embodiment.

[Drawing 4]Many cells are the appearance top views of the laminate type battery which it comes to connect in series.

[Drawing 5]It is a figure showing the pattern of each class of the laminate type battery concerning this embodiment.

[Drawing 6]It is a figure showing the composition of the printer head used in the manufacturing method of this embodiment.

[Drawing 7]It is an appearance top view of the laminate type battery which has various gestalten.

[Drawing 8]It is a figure showing the composition of the cell group concerning a 2nd embodiment.

[Description of Notations]

100 Base

200 Battery element part

210 Cell

211 Cell layer

211a Positive electrode layer

211b Electrolyte layer

211c Negative electrode layer

212 Collector layer
300 Electric circuit part
310 Electrode terminal
311 Positive pole terminal
312 Bipolar electrode terminal
313 Negative pole terminal
320 Electric circuit
400 Insulating part
500 Printer head
510 Nozzle
520 Filter
530 Ribbon heater
1000 Laminate type battery
2000 Celcon troller

[Translation done.]